

TRENDS OF THESES ABOUT SOCIOSCIENTIFIC ISSUE (SSI)-BASED TEACHING IN THAILAND

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ABSTRACT

Under Thai educational reform, science learning processes concern with the current situations in daily life. The aim of this study was to identify the trends of theses regarding Socioscientific Issue (SSI)-based teaching in Thailand. The researchers gathered the information by first handedly reviewing theses related to SSI-based teaching from thesis databases in Thailand. The collected data were analyzed using content analysis. The findings showed that 41 theses about SSI-based teaching were found during years 2008-2014. Most of them were conducted in a master level education and focused on higher-order thinking. For content knowledge related to SSI, various SSIs were used in science classrooms rather than using single SSI. In addition, most of the content knowledge that the researcher(s) investigated was related to biotechnology. For the participants who were concerned with SSI-based teaching, most of the theses conducted with participants in lower secondary and higher secondary level. Moreover, quantitative research was used as research methodology rather than mix-method study or qualitative research. For the student benefits, SSI-based teaching could promote students in aspects related to higher-order thinking.

KEYWORDS: Socioscientific Issue, Science Education, Trends of Theses

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INTRODUCTION

Currently, Thailand is experiencing rapid scientific and technological change in response to the accelerating economic development. As a result, there are several dilemmas which have arisen. For example, a Socioscientific Issue (SSI) has arisen with the proposed construction of a new dam within Thailand's Mae Wong National Park. The proposed government project will ensure that the water volume will be adequate for local communities. However, the dam will eliminate approximately 17.6 square kilometers of low lying forest within the national park and result in a loss of a habitat for many animals, including Thailand's native tigers. Conservationists argue that without a proper study of the potential environmental impact of the dam, Thailand may lose one of its most abundant forest regions [1]. Another example of a SSI involves a conflict between wild elephants and farmers. As farmers clear forests, build homes, and plant crops, wild elephants often leave the forest and scavenge for food within the farmers' fields. The plentiful food supply is very attractive to the elephants during periods of drought or food shortages within deeply forested regions [2]. As elephants leave the forest for cultivated food sources, conflicts between the elephants and humans are becoming more prevalent and wild elephants have attacked tourists traveling throughout the nearby Khao Yai National Park. The common theme within the dilemma posed by each of these issues is a conflict between human needs and the conservation of Thai resources.

Consequently, a lack of understanding of the interaction between the needs of society and science may lead to feelings of fear, anger, and distrust towards the scientific community [3]. Therefore, it is important that school science provides students with experience concerning direct impact and relevance to their present and future social experiences.

As 21st century learning and teaching is viewed as a microcosm of society that relate to reasoning about SSI, students should be provided with an experience that will have direct impact and relevance to their present and future social experiences [4]. Therefore, teaching about SSI is considered to be a way to promote scientific literacy for citizenship [5] by creating a more real image of scientific activity [6]. The discussion of SSI in the classroom is useful not only in terms of students' learning about content, processes and the nature of science and technology, but also in term of students' cognitive, social, political, moral and ethical development [7]. Unfortunately, the discussion of SSI is an uncommon practice in science classes. Some teachers avoid discussing these issues for fear of protests by the students' parents and a possible lack of control during the discussions [8]. Many science teachers also see their tasks as teaching the facts and not discussing any of the social, moral and ethical implications of science and technology [9].

According to Thai educational reform, Thai National Education Act B.E. 2542 (A.D.1999) and Amendments B.E. 2545 (A.D. 2002) focuses on enabling Thai students to develop themselves at their own pace and potential. The content of each level of education places emphasis on knowledge about the relationship between oneself and society, knowledge of science, management, conservation, and the utilization of natural resources to ensure that the environment is balanced and sustainable (Office of the National Education Commission [10]. To confirm this idea, the link between SSI curricula and the learning of science content still remains significant in order to enable students to use their understanding of science to contribute to the public debate and make informed and balanced decisions about SSIs that impact on their lives [11]. In addition, infusion of scientific content with moral and ethical perspectives about SSIs can promote students' learning engagements and understanding of SSIs [12].

However, SSI-based teaching is new in Thai context. It still has questions about the trends of research especially theses about SSI-based teaching in Thailand. To better understand SSI-based teaching in Thailand, the researchers as science educator should know the trends of theses about SSI-based teaching in Thailand.

RESEARCH OBJECTIVE

The purpose of this study was to survey the trends of SSI-based teaching in Thailand. To achieve the purpose of this study, the research question was formulated as: what are the trends of theses about SSI-based teaching in aspects of the focus of teaching, content knowledge related to SSI, research participants, research methodology, and the benefit for students related to SSI-based teaching in Thailand?

THEORETICAL FRAMEWORK

The research presented in this work was set within the conceptualization of the SSI-based approach, which is considered to be an effective way to promote scientific literacy for citizenship [5] by creating a more realistic image of scientific activities [6]. Although SSI is controversial by nature, not all controversial issues are considered to be SSIs. The characteristics of SSI are typically open-ended, ill-structured and debatable problems, which can promote students' argumentation and decision-making on this issue [13]. Therefore, SSIs are social dilemmas with conceptual or technological links to science. They are open-ended because they do not have a direct answer or solution and are ill-structured because of the fact that they are controversial in nature in addition to having explanations from different areas.

On the other hand, they are said to be debatable in the sense that they are based upon individual's or groups of individuals' opinions and understandings taken into consideration of ethical, political, economic, cultural and sometimes even religious concerns about the issue [7]. Thus, the features associated with reasoning about SSI takes on increased importance if teachers understand that the development of meaningful concepts requires the joint construction of scientific knowledge that is at once personally relevant and socially shared [14].

For SSI-based learning teaching, there should be both a collaborative and interactive environment in science classrooms. In addition, students and teachers should demonstrate respect for one another [15]. Teachers can also use SSI as a useful context for learning specific scientific knowledge [11], [16], analytical thinking, understanding of the nature of science, learning satisfaction [16], addressing citizenship education [17], improving argumentation skills [18], and promoting decision making skills [19].

RESEARCH METHODOLOGY

To investigate the trend of theses about SSI-based teaching in Thailand, a qualitative research procedure based on an interpretive paradigm was used to build a phenomenological account of human thinking. The researchers believe that interpretive methodology can provide the view that reality is constructed by individuals' interactions with their social world. It examines how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences [20].

Before reviewing theses related to SSI-based teaching, the researchers adapted criteria to select theses topic to review from Topcu, Mugaloglu, and Guven (2014) as 1) conducting in Thailand context; 2) examining contemporary investigation

During 2008-2014; 3) using SSI in science teaching; and 4) using the first hand data collection [21]. Then, the researchers searched theses about SSI-based teaching from database of the university library in Thailand and using "socioscientific issue" and "socioscientific issue-based teaching" as keywords. After getting these reviews, the researchers read each thesis for interpreting and open-coded looking for emerging categories linked to the research question. In order to maximize reliability and internal validity, the data collection, coding, and analysis were examined and reviewed by experts in science education, who gave the researchers feedback on the accuracy of the process.

RESEARCH FINDING AND DISCUSSIONS

The researchers could identify the theses concerning SSI-based teaching in the range of years 2008-2014 (the current year of study). There were 41 theses concerning SSI-based teaching found from databases from the university library in Thailand. Most of them (40 theses) were Master theses. There was only one thesis conducted in doctoral level education concerning SSI-based teaching. For more details, the trends of focus of teaching, content knowledge related to SSI, research participants related to SSI-based teaching, research methodology related to SSI-based teaching, and the benefit for students related to SSI-based teaching were presented in the following paragraphs.

Focus of SSI-Based Teaching

The researchers found that most of the theses (40) focused on higher-order thinking, such as argumentation abilities, critical thinking, analytical thinking, logical thinking, and decision making. Consistently, Presley *et al.* (2013) identified that teachers could use SSI-based teaching for providing students the opportunity to do higher order practice

[16]. In addition, there were 6 theses focusing on students' understandings of scientific concepts behind SSIs and 2 theses focusing on science process skills, and focusing on students' attitudes toward science or science learning attitude. The following focused on using SSI-based teaching in a science classroom was promoting students' moral aspects, such as moral or ethical reasoning (1 thesis). Zeidler and Keefer (2003) identified that a moral perspective is one of the most important components of SSI-based learning [14]. Furthermore, there was one thesis focusing on scientific literacy, which Roberts (2007) indicated that SSIs can promote scientific literacy by taking into context of real-life situations that are scientific in nature but are influenced by other factors, such as social, political, and ethical issues [22]. However, this present study showed that no theses focused on students' understandings of the nature of science. In fact, Presley *et al.* (2013) identified that SSI-based teaching can be used to promote students' learning of the nature of science (NOS) themes in the classroom [15].

Content Knowledge Related to SSI

Most of the theses (29 theses) used various SSIs in science classroom. There were only 12 theses that used single SSI in their studies. The content knowledge related to SSI that the researcher(s) investigated most (29 theses) was about biotechnology such as cloning, stem cells, artificially fertilized baby (in vitro fertilization) embryo transfer, GMOs, DNA fingerprinting, and human genome project. The following contextual knowledge related to SSI was about natural resources (24 theses). For example, the researcher(s) mentioned resort construction in the natural forest; forest trees cutting for highway construction, trees cutting for road construction, such as building a resort in forested area, dam construction, using underground water and potash mining, oil spills in the sea, fish catching during egg laying season, and lizard hunting causing imbalance nature. For SSI-related to health, the researcher(s) mentioned free abortion, commercial organ transplantations, and trafficking of surrogacy (19 theses). In addition, there were some theses identified about alternative energy, such as nuclear power plant (8 theses); climate, such as global warming (2 theses); pollution, such as rice and sugar cane straws burning (1 these). This finding was similar to that of Hanegan, Price, and Peterson (2007) who found that teachers could infuse scientific content with moral and ethical perspectives about SSIs to promote students' learning participation and understanding of SSIs [23].

Research Participants Related to SSI-Based Teaching

The researchers found that the participants who were concerned with SSI-based teaching ranged from elementary students to undergraduate students. In addition, there are vocational students. Most theses conducted in lower secondary (grades 7-9) and higher secondary (grades 10-12) level in the same number (18 theses). Some of them (4 theses) were higher elementary students (grades 4-6), but the researchers did not find theses concerned with SSI-based teaching in lower elementary (grades 1-3) level. This finding showed that SSI-based teaching was accepted and adapted into school science curriculum from elementary to secondary level as found in many countries, such as England [24], and Turkey [25]. However, there was only one thesis studied with second year - vocational students.

Research Methodology Related to SSI-Based Teaching

Most of the theses (40 theses) about SSI-based teaching used quantitative research as a research methodology. The researcher(s) emphasized students' scores of certain aspects, such as argumentation ability scores before and after teaching. There was only one thesis that used mix-method studies as research methodology. For this methodology, the researcher(s) tried to use qualitative data from informal interviews and observation data to support the quantitative data. However, there

was no thesis that mainly used qualitative research as its methodology. Similarly, Topcu, Mugaloglu, and Guven (2014) found that the trends of research methodology in Turkey mainly employed quantitative research [21].

The Benefit of SSI-Based Teaching

The researchers found that most theses showed that SSI-based teaching is able to promote students' higher-order thinking (40 theses) such as argumentation abilities, critical thinking, analytical thinking, logical thinking, and decision-making. Some of the theses (6 theses) identified that students could develop their understanding of scientific concepts or content. In addition, there were 4 theses showed that SSI-based teaching science learning attitudes and moral perspectives. In this present study, there were also 2 theses that showed that this approach improves students and can develop their science process skills. Although SSI have become important in science education because they have a central role in promoting scientific literacy [14], in this present study, there was only one these identified that SSI-based teaching approach can promote students' scientific literacy.

CONCLUSIONS AND RECOMMENDATIONS

This research study contributes to a better understanding of the trends of theses about SSI-based teaching in Thailand. The findings showed that most theses found that years 2008-2014 focused on higher-order thinking. For content knowledge related to SSI, there were some theses that used single SSI in science classrooms. The content knowledge related to SSI that the researcher(s) investigated most were about biotechnology such as cloning, stem cells, and GMOs. For the research participants who were concerned with SSI-based teaching, most theses studies were in lower secondary and higher secondary level. Moreover, the researchers found that most of these theses used quantitative research as research methods rather than mix-method study and qualitative research. For the benefit of the students, SSI-based teaching could promote students in various aspects according to 21st century skills such as higher-order thinking. For recommendations, it can be suggested that the universities that are involved in science teaching could use more SSI-based teaching to lower elementary level and higher education. In addition, the researcher should focus on qualitative research on SSI-based teaching. For future study, the researcher should study about the trends of research articles about SSI-based teaching published in journals in Thailand.

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